Introduction to Engineering Design
Fall 2015

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Office Hours: Wednesday 10:00-11:59 am and by appointment
Class Times: T789 = 2 hour for Design Lab + 1 hour for CAD Lab
Class Location: Eng I 827 (Computer Lab)
Class TA: 翁敏鳳 wyumi0212@gmail.com Office: 913 ENG I
TA Office hour: Monday afternoon at 913 Ext:33949
Class Web: iLMS (http://lms.nthu.edu.tw/course/23504)

Course Overview

This course is an introduction to the process of engineering design. While taking this course, you will learn and apply the key steps of the design process. Along the way, you will employ other skills and tools that you'll need in your career as an engineer, such as teamwork, communication skills (graphical, oral, and written), and computer-aided design & analysis tools. Two design projects will be assigned during the semester, along with other assignments, both team based and individual, to help you learn the skills required.

Course Objectives

- Conceptually design a system, component, product, service, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Apply knowledge of basic science and mathematics to engineering
- Identify, formulate, and solve engineering problems
- Conduct basic experiments as well as analyze and interpret data
- Function effectively in small teams
- Communicate effectively in oral, written, and graphical media
- Use CAD, spreadsheet, and internet application tools relevant to engineering practice

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Skills Acquired in ED

After completing this course, you will have acquired the following skills:

Design Methods	Customer needs assessments, concept generation, design selection matrices, demand forecasting, prototyping, safety, economic considerations, teamwork, ethics
Computing	SolidWorks (Solid Modeling/CAD), MS Excel (spreadsheets), MS Power Point (multimedia presentations)

Lab Work	Experimental methods, data acquisition and analysis, prototype building and testing
Presentations	Develop and present a technical presentation both as part of a team and individually

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Textbook

Introduction to Engineering Design - McGraw Hill Learning Solutions,©2008 ISBN-13: 978-0-07-723421-8 (paperback)

Reference

Ulrich, K. T. and Eppinger, S. D., 2004, Product Design and Development, 3rd Edition, New York, Irwin McGraw-Hill.

Engineering Design: A Practical Guide, by Madara Ogot and Gül Kremer. Trafford Publishing, 2004.

Grade Construction:

You will be evaluated based on a broad spectrum of assignments. Your grade will be determined in the following fashion:

- Design Projects – 50%
  - Toothbrush Design Project – 20%
    - Team presentation 5%
    - Design Report and Results 10%
    - Class participation 5%
  - 2nd Design Project – 30%
    - Team presentation 5%
    - Design Prototype 10%
    - Design Report 10%
    - Class participation 5%

- Examinations – 25%
  - CAD Quiz 5%
  - TEST #1 10%
  - TEST #2 10%

- Design Communication Assignments/Homework – 25%
  - Regular Assignments 15%
  - CAD Assignments 5%
  - Bad Design assignment 5%

Grading Policy:

The major lesson to be learned in this course is that it is ok to make mistakes. If you feel frustrated that something isn't working out, don't worry! Design projects will be evaluated on the basis of effort and how well you followed the design process, and not whether the "correct" result was obtained. When it comes time to put together final grade, the following grade cutoffs will be applied.

%Range	100 – 90	89 – 85	84 – 80	79 – 77	76 – 73	72 – 70	69 – 60	59 – 50	49 – 1
Letter	A+	A	A-	B+	B	B-	C	D	E

ED Class Policies

The following are some ground rules to help us progress steadily through the semester:

1. **Attendance is mandatory for all class periods.** Because this class meets for 1.5 hours each session, significant material is covered each class session. You need to be present to learn and contribute to your team's success. Course grade will be dropped to the next lower grade (such as from A - to B+) for every three classes missed Also, the course grade will be dropped to the next lower grade if there is a pattern of tardiness. Missing class due to family vacation is not an excused absence. *If possible, send the e-mail to me (mcchiu@ie.nthu.edu.tw) before class if you are sick or injured and will not be attending class.*

2. If you have an excused absence that results in missing a quiz or other major assignment, you must discuss this with me *prior* to the quiz.

3. Late assignments (*i.e.*, those not turned in at the **beginning** of the class period they are due) are graded out of 80%. Assignments turned in late will be graded, but with a 20% grade reduction for every week beyond the due date.

4. The instructor will discuss any exam or assignment grade within 48 hours (excluding weekends and holidays) of its return, after which time the discussion is closed.

5. The Design and Computer labs cannot be made up if they are unique and involve team work.

6. Students are responsible for any missed handout and homework assignment for any unexcused missed class.

7. Changes to assignments will be announced in class and supersede what is on the syllabus (the syllabus may be updated periodically without prior notice, please check iLMS weekly for updates). If you miss a class for an excused absence, it is your responsibility to ensure that you have the proper assignment.

8. Teams are expected to address team member problems (such as missed meetings or not completing work). However, do not let a small team issue or problem develop into a major conflict. Contact the class instructor to help address and correct the problem early!

9. Excellent team work can improve your project grade by as much as 2% per design project. Poor teamwork can lower your course grade by the same amount. A project grade is determined for each project, and team peer evaluations will be used to determine your final score for that project. Students earning high peer evaluation scores will see a project grade boost, and students earning a low peer evaluation scores will see a grade decrease.

10. Cell phones are to be *turned off* or *in silent mode* when in class. No IM and newspaper during the class.

Tentative Class Schedule

Week #	Date	Design Lab (2 hr)	Computer Lab (1 hr)
1	9/15	Introduction	Design process overview (Airplane Exercise)
2	9/22	Identify Problem (Customer Needs) Design Project #1 kick off	CAD Session #1: Parts (Solidworks)
3	9/29	Product Specification	CAD Session #2: Assemblies (Solidworks);
4	10/06	Product Dissection I	CAD Session #3: Drawing & Offset Entities (Solidworks)
5	10/13	Product Dissection II	CAD session #4: Design Tables & Dynamic Mirror Entities (Solidworks)
6	10/20	**Bad Design Presentation**	
7	10/27	Concept Generation I	CAD session #5: Sections(Solidworks)
8	11/03	Concept Selection	CAD Session #6: Revolve & Sweep(Solidworks)
9	11/10	**Project #1 presentations**	**Project #1 report due**
10	11/17	**Test 1**	
11	11/24	Service Innovation Design Project #2 kick off;	CAD Session #7: Loft (Solidworks)
12	12/01	Design Thinking	CAD Session #8: Working Drawing, Trim/Convert Entities & Linear Pattern (Solidworks)
13	12/08	Project Management	Rapid Prototyping (I)
14	12/15	Concept Generation II (IDEO Methods)	Rapid Prototyping (II)
15	12/22	Concept Selection II	**CAD Quiz – In-class**
16	12/29	Product Development Economics	
17	1/05	**Design Project #2 presentations**	**Design Project #2 report due**
18	1/12	**Test 2**	

國立清華大學課程大綱-大學部

科號	IEEM 207000	組別	00	學分	3	人數限制	30
上課時間	T789			教室	102		

科目中文名稱	工程設計概論		
科目英文名稱	Introduction to Engineering Design		
任課教師	邱銘傳		
擋修科目	工程圖學一	擋修分數	59

※下列各欄由任課教師提供※

依 IEET 與評鑑精神,本系擬定之核心能力如下,教師請勾選本課程所欲培養之核心能力,並根據此建立核心能力達成指標, 以課程評分量表(Rubrics)作為評估方法, 並依據此評分量表確認及評估教學成效, 是否作後續教學改進之用。(課程對應之核心能力並非要求"全選", 無對應到的核心能力"可以不選")

此科目對應之系所課程規畫所欲培養之核心能力 Core capability to be cultivated by this course	■	將工業工程與工程管理各項技術整合應用 integrate and apply the technologies of industrial engineering and engineering management	10 %
	■	資訊科技的善加應用，以利解決工工領域之問題 application of information technology to solve the problem in the field of industrial engineering and engineering management	10 %
	■	能發揮高度的智慧，有效處理工工領域相關議題 Deal intelligently with issues related to the field of industrial engineering and engineering management	25 %
	■	協調溝通與團隊精神的發揮 Coordination , communication and teamwork	25 %
	■	激發創造力、培養創新思維 Inspire creativity and develop innovative thinking	30 %
	□	具備國際觀的心胸、視野，與執行國際化的能力 Having an international perspective, vision, and ability to perform globally	%

核心能力 1：將工業工程與工程管理各項技術整合應用				
核心能力 達成指標	**非常滿意 (>=90)**	**滿意 (80~90)**	**尚可 (70~80)**	**不滿意 (<70)**
透過課程瞭解工程設計的基本概念，獲得相當程度的工程設計經驗，並由作業進行課程知識與軟體操作之驗收。	瞭解工程設計的基本概念，透過課程獲得相當程度的工程設計經驗，並由作業進行課程知識與軟體操作之驗收有深入瞭解	瞭解工程設計的基本概念，透過課程獲得相當程度的工程設計經驗，並由作業進行課程知識與軟體操作之驗收有所瞭解	瞭解工程設計的基本概念，透過課程獲得相當程度的工程設計經驗，並由作業進行課程知識與軟體操作之驗收僅部分瞭解	瞭解工程設計的基本概念，透過課程獲得相當程度的工程設計經驗，並由作業進行課程知識與軟體操作之驗收瞭解極少
運用數學、自然科學及工程科學的定律，發掘、整理、研究文獻及分析複雜的工程問題，以達成有根據的結論。	運用數學、自然科學及工程科學的定律，發掘、整理、研究文獻及分析複雜的工程問題之應用有深入瞭解	運用數學、自然科學及工程科學的定律，發掘、整理、研究文獻及分析複雜的工程問題之應用有所瞭解	運用數學、自然科學及工程科學的定律，發掘、整理、研究文獻及分析複雜的工程問題之應用僅部分瞭解	運用數學、自然科學及工程科學的定律，發掘、整理、研究文獻及分析複雜的工程問題之應用瞭解極少

核心能力 2：資訊科技的善加應用，以利解決工工領域之問題				
核心能力 達成指標	**非常滿意 (>=90)**	**滿意 (80~90)**	**尚可 (70~80)**	**不滿意 (<70)**
運用 3D 實體模型建構系統 Solidworks，以最少的時間完成創新的產品設計雛型，並提升對產業機械設計自動化的學習。	運用 3D 實體模型建構系統 Solidworks，以最少的時間完成創新的產品設計雛型，並提升對產業機械設計自動化的學習非常熟悉	運用 3D 實體模型建構系統 Solidworks，以最少的時間完成創新的產品設計雛型，並提升對產業機械設計自動化的學習有所瞭解	運用 3D 實體模型建構系統 Solidworks，以最少的時間完成創新的產品設計雛型，並提升對產業機械設計自動化的學習僅部分瞭解	運用 3D 實體模型建構系統 Solidworks，以最少的時間完成創新的產品設計雛型，並提升對產業機械設計自動化的學習仍不熟悉
在工程設計中善用現有的分析軟體或網路平台進行特定概念生成與篩選，以有效地整合創新的設計流程。	在工程設計中善用現有的分析軟體或網路平台進行特定概念生成與篩選，以有效地整合創新的設計流程非常瞭解	在工程設計中善用現有的分析軟體或網路平台進行特定概念生成與篩選，以有效地整合創新的設計流程有所瞭解	在工程設計中善用現有的分析軟體或網路平台進行特定概念生成與篩選，以有效地整合創新的設計流程僅部分瞭解	在工程設計中善用現有的分析軟體或網路平台進行特定概念生成與篩選，以有效地整合創新的設計流程仍不熟悉

核心能力 3：能發揮高度的智慧，有效處理工工領域相關議題				
核心能力 達成指標	**非常滿意 (>=90)**	**滿意 (80~90)**	**尚可 (70~80)**	**不滿意 (<70)**
透過開放性問題來發展與運用工程理論以描述設計問題，思考方案可行性及其替代方案。	透過開放性問題來發展與運用工程理論以描述設計問題，思考方案可行性及其替代方案有	透過開放性問題來發展與運用工程理論以描述設計問題，思考方案可行性及其替代方案有	透過開放性問題來發展與運用工程理論以描述設計問題，思考方案可行性及其替代方案僅	透過開放性問題來發展與運用工程理論以描述設計問題，思考方案可行性及其替代方案仍

	深入瞭解	所瞭解	部分瞭解	不熟悉
設計出解決複雜問題的方案。	對設計出解決複雜問題的方案有深入瞭解。	對設計出解決複雜問題的方案有所瞭解。	對設計出解決複雜問題的方案僅部分瞭解。	對設計出解決複雜問題的方案仍不熟悉。

核心能力 4：協調溝通與團隊精神的發揮				
核心能力 達成指標	**非常滿意 (>=90)**	**滿意 (80~90)**	**尚可 (70~80)**	**不滿意 (<70)**
可以在團隊報告中發揮團隊綜效	可以在團隊報告中徹底發揮團隊綜效	可以在團隊報告中發揮團隊綜效	在團隊報告中無法完全發揮團隊綜效	無法在團隊報告中發揮團隊綜效
團隊中成員彼此相處融洽且可以包容各種意見	團隊中成員彼此相處融洽且可以包容各種意見	團隊中成員彼此可以包容各種意見	團隊中成員彼此無法採納各種意見	團隊中成員彼此無法相處且無法採納各種意見

核心能力 5：激發創造力、培養創新思維				
核心能力 達成指標	**非常滿意 (>=90)**	**滿意 (80~90)**	**尚可 (70~80)**	**不滿意 (<70)**
瞭解工程設計的方法流程與創新技術，並應用設計者的創造本能，將使用者對產品的認知與感覺融入產品中	瞭解工程設計的方法流程與創新技術，並應用設計者的創造本能，將使用者對產品的認知與感覺融入產品中有深入瞭解	瞭解工程設計的方法流程與創新技術，並應用設計者的創造本能，將使用者對產品的認知與感覺融入產品中有所瞭解。	瞭解工程設計的方法流程與創新技術，並應用設計者的創造本能，將使用者對產品的認知與感覺融入產品中僅部分瞭解。	瞭解工程設計的方法流程與創新技術，並應用設計者的創造本能，將使用者對產品的認知與感覺融入產品中仍不熟悉。
透過工程設計中以團體討論、個人創作，鼓勵使用不同的思考模式或設計方法以產生新的構想創意。	透過工程設計中以團體討論、個人創作，鼓勵使用不同的思考模式或設計方法以產生新的構想創意有深入瞭解	透過工程設計中以團體討論、個人創作，鼓勵使用不同的思考模式或設計方法以產生新的構想創意有所瞭解。	透過工程設計中以團體討論、個人創作，鼓勵使用不同的思考模式或設計方法以產生新的構想創意僅部分瞭解。	透過工程設計中以團體討論、個人創作，鼓勵使用不同的思考模式或設計方法以產生新的構想創意仍不熟悉。